Minnesota Pollution Control Agency

Prepared in cooperation with the Minnesota Department of Natural Resources

Peltier Lake

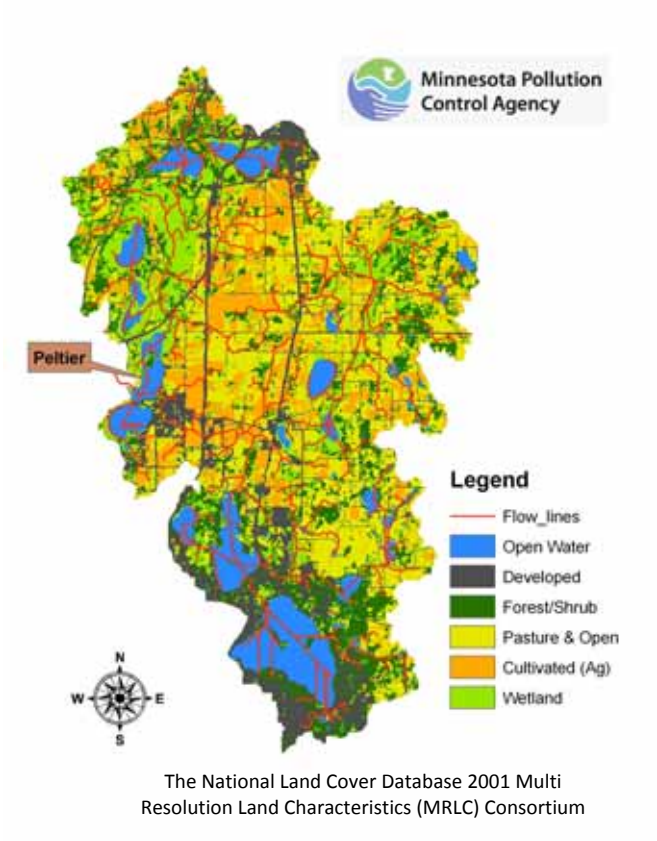
Anoka County

Sentinel Lakes

Minnesota Lake ID: 02-0004
Area: 483 Acres
Watershed Area: 68,318 acres
Ecoregion: Northern Central Hard Wood Forest (NCHF)

Trophic State: Mesotrophic
Maximum Depth: 18 feet
Mean Depth: 7 feet
Mixing Status: Well Mixed (Polymictic)

Figure 1. Peltier Lake watershed land use



The National Land Cover Database 2001 Multi Resolution Land Characteristics (MRLC) Consortium

Figure 2. Peltier Lake 3D depth contour

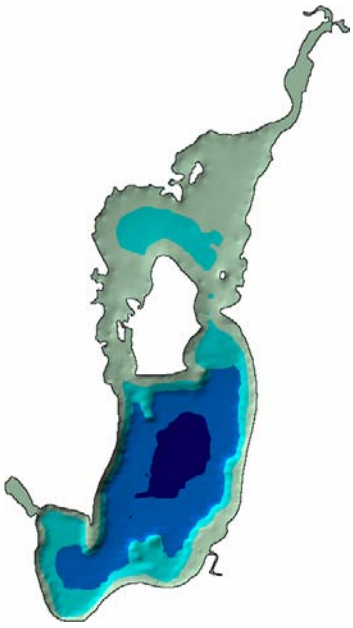


Table 1. Land use composition

Land use	Peltier Lake land use percentage	NCHF typical land use percentage
Developed	19	2 – 9
Cultivated (Ag)	19	22 – 50
Pasture & Open	39	11 – 25
Forest	8	6 – 25
Water & Wetland	15	14 – 30
Feedlots (#)	7	

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Table 2. Peltier Lake summer-mean as compared to typical range for NCHF ecoregion reference lakes MPCA data based on 2008 sample collections

Parameter	Peltier Lake	NCHF
Number of reference lakes		43
Total Phosphorus (µg/L)	234	23 – 50
Chlorophyll mean (µg/L)	55	5 – 22
Secchi Disk (meters)	1.2	1.5 – 3.2
Total Kjeldahl Nitrogen (mg/L)	2.6	<0.6 – 1.2
Alkalinity (mg/L)	145	75 – 150
Color (Pt-Co U)	65	10 – 20
pH (SU)	7.9	8.6 – 8.8
Chloride (mg/L)	83	4 - 10
Total Suspended Solids (mg/L)	9.3	2 - 6
Total Suspended Inorganic Solids (mg/L)	1.5	1 - 2
Conductivity (umhos/cm)	440	300 - 400
TN:TP ratio	11:1	25:1 - 35:1

µg/L = micrograms per liter	Pt-Co-U = Platinum Cobalt Units
mg/L = milligrams per liter	SU = Standard Units
umhos/cm = micromhos per centimeter	

Figure 3. Peltier Lake 2008 temperature and dissolved oxygen (DO) profiles

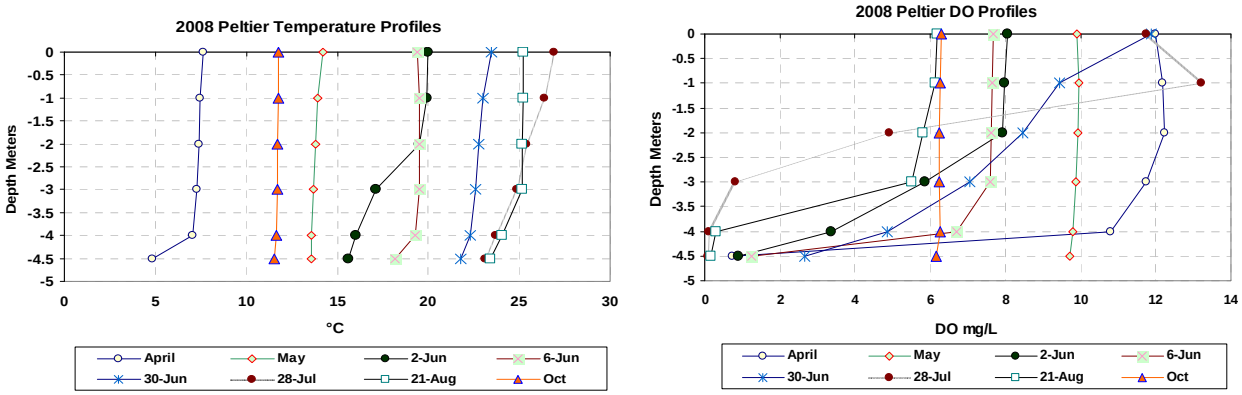


Figure 4. Lake Peltier summer 2008 total phosphorus (TP), chlorphyll-a (Chl-a), and secchi

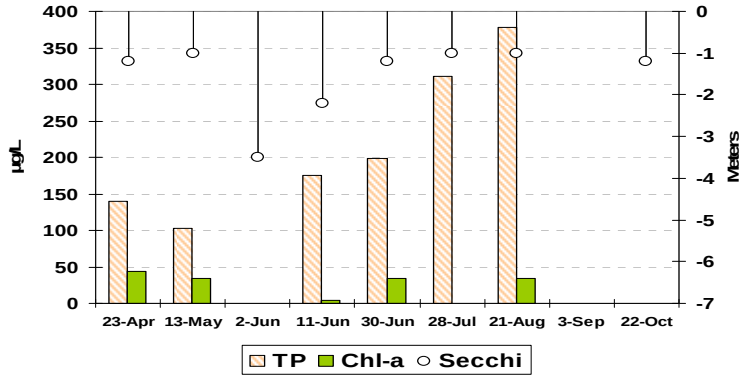
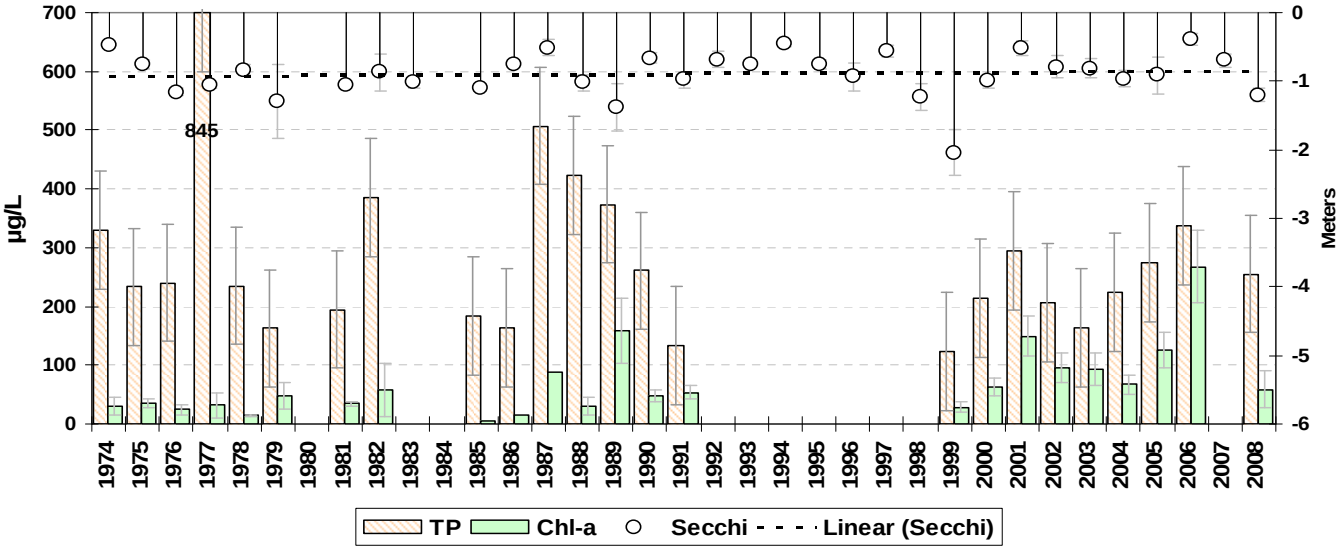


Figure 5. Summer mean trophic indicators



Water quality, watershed and fishery management issues

Peltier is a modest–sized, shallow lake (71 percent littoral) with a maximum depth of 18 feet. The lake has a large watershed-to-lake area ratio of 142:1. The watershed is located in the central portion of the Rice Creek Watershed District (RCWD), which lies entirely within the NCHF ecoregion. Portions of 13 cities/townships and three counties are contained in the Peltier Lake watershed. Peltier was assessed as non-supporting of aquatic recreational uses and was included in the 2002 303(d) "impaired waters" list for aquatic recreation because of nutrient over enrichment. A vast amount of monitoring and study have been done on the lake. The final Total Maximum Daily Load study report is near completion.

Lake monitoring in 2008 was a collaborative effort between the MPCA, RCWD and volunteer monitor, Wayne LeBlanc. Trophic indicators varied significantly in the 2008 monitoring season (Figure 4), which is likely the combined influence of watershed TP loading and episodic internal loading from the sediments and curly-leaf pondweed senescence in mid-summer.

Peltier was thermally well-mixed on most sample dates (Figure 3); however, when there was a very slight temperature gradient (e.g. August 21; Fig. 3) DO fell below 2 mg/L. These periods of low- or no-DO near the sediments allows for internal recycling of phosphorus from the sediments, which can contribute to elevated TP in the upper waters upon wind-mixing.

Peltier Lake has a very long database and ranges from eutrophic to hypereutrophic, with relatively higher TP and Chl-a concentrations compared to transparency (Figure 5). TP concentrations have varied over the years, with annual means ranging from approximately 100 to >800 µg/L. Curly-leaf pondweed is present in the lake and is thought to contribute to phosphorus loading and seasonal cycle of increasing TP in mid to late summer (Figure 4).

Fishery and aquatic plant survey summary

Table 3. Focal species captured during recent surveys and their size and abundance compared with other lakes in its lake class

Species	Stocked	Abundance	Size	Population Trend
Walleye*	Y	Not detected	Not detected	Fluctuating
Northern Pike	N	Average	Average	Increasing
Black Crappie	N	Average	Average	Stable
Largemouth bass	N	Low	Average	Can not determine
Pumpkinseed	N	Average	Small	Stable
Bluegill	N	Average	Average-large	Can not determine
Yellow perch	N	Average	Small	Stable
Channel Catfish*	Y	Not detected	Not detected	Can not determine
White Sucker	N	High	Large	Stable

*Management emphasis on these species

Table 4. Aquatic plant summary

Percent cover of aquatic plants ≤ 15ft deep	54%
Number of common species (i.e., ≥ 10% cover)	2
Lake depth at which most vegetation disappeared	4.8ft
Infested	Curly-leaf pondweed (heavy)
	Eurasian watermilfoil (lightly)

Narrative

The most recent winter creel survey in 2003 demonstrated that the lake is a popular winter fishery for black crappies and northern pike supporting large harvests. Average weights of black crappies sampled in lake survey trap nets in 2008 were at an all-time high of 0.35 lbs. /fish for the lake (average compared with other similar lakes). Northern pike numbers and size were average compared with other years and similar lakes

Peltier has a history of low winter DO and periodic winterkill. A pump and baffle winter aeration system was installed in 1988 to minimize winterkill episodes. At this same time, alternate-year walleye fry stocking and annual yearling channel catfish stocking began. Since their introduction, walleye and catfish populations have been variable. Neither of these species was sampled during a population assessment in summer 2007 or a special trap net assessment in spring and summer 2008. Bluegill size-structure is above average. Thirty percent of fish captured in summer 2008 trap nets were > 7 inches.

Despite aeration and abundant vegetation in shallow areas of the north basin (Figure 1), largemouth bass catches in 2008 were relatively low. Peltier is heavily infested with the non-native curly-leaf pondweed and lightly infested with Eurasian watermilfoil. Curly-leaf pondweed presumably contributes a positive feedback to the nutrient loads in Peltier through rapid growth in spring and senescence in mid-summer that releases nutrients into the water column.